Office of
ELECTRIC TRANSMISSION & DISTRIBUTION
ELECTRIC DISTRIBUTION TRANSFORMATION PROGRAM

Institute of Electrical and Electronics Engineers

Interconnection Standards Development

Background

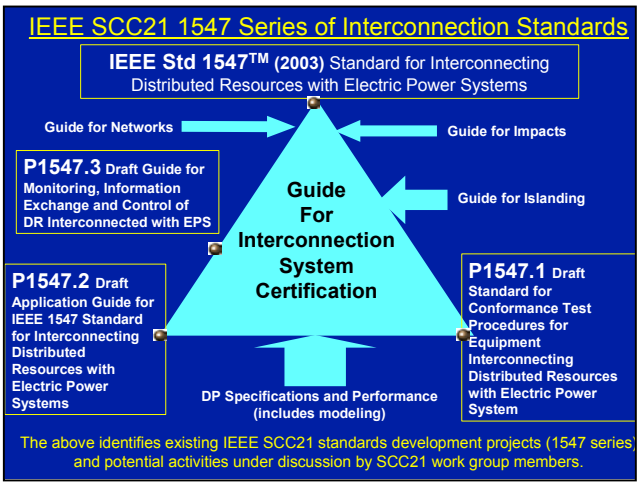
Distributed resources (DR) are expected to make the electric power system (EPS) more flexible and secure. DR also promise to lower the cost of electricity, make generation cleaner and more efficient, reduce transmission and distribution line loss and congestion, and improve power reliability and quality. However, DR lack universal requirements for interconnection with EPSs.

To interconnect DR for safe and reliable operation, many requirements must be met. Technical requirements for interconnection vary by state and utility, and some cases include major barriers to an orderly integration of DR with the grid. The lack of uniform national requirements and tests for DR interconnection, operation, and certification and the lack of uniform national building, electrical, and safety codes are problems. However, standardized technical consensus requirements can help. They provide a framework for product and service quality, interoperability, lower engineering and design costs, and streamlined installation, operation, and maintenance. They also help safeguard against hazards. Uniform standards and simplified contractual and other institutional interconnection requirements at the state and local levels will facilitate industrial efficiency and a broader market for DR by satisfying the needs of the increasingly competitive electricity industry.

IEEE 1547 Series Standards

National consensus requirements take time to develop and promulgate acceptance. A new standard, Institute of Electrical and Electronics Engineers (IEEE) 1547™(2003), the first in a family of IEEE interconnection standards, gives utilities the technical framework they need to integrate DR. The development and success of IEEE 1547 was due to partnerships that included utilities, manufacturers, energy service companies, universities, government laboratories, and state and federal government.

The implementation of 1547 will help ensure that investments in DR and modern grid technologies result in real-world applications providing technically sound sources of electric power for the utility grid. This national standard will have a significant effect on how the energy industry does business and will influence the way the electrical distribution system operates. IEEE 1547 will be used in federal



IEEE Standards Coordinating Committee 21
1547 Series of Interconnection Standards

legislation and rulemaking, in state PUC deliberations, and by more than 3,000 utilities to formulate technical requirements for interconnection agreements. It also provides an international link in today's world electric industry.

Like 1547, the additional standards in the series are being developed through the IEEE consensus process. Support from working group members and the electric power community was and continues to be overwhelming. From 1547's inception in March 1999, the working and ballot group grew to 444 members. About 100 attendees met several times a year for development. Their efforts were instrumental to the success of the standard.

IEEE and SCC21

IEEE is a nonprofit, technical, professional association of 380,000 members in 150 countries that is focused on electronic and information science and technology. IEEE has 900 active standards, and 400 more are under development.

IEEE Standards Coordinating Committee 21 (SCC21) oversees the development of standards in the areas of fuel cells, photovoltaics, dispersed generation, and energy storage. It coordinates among IEEE societies and other organizations. This ensures standards are consistent and reflect the views of all applicable disciplines. SCC21 also reviews proposed standards in its disciplines before their submission to the IEEE Standards Association Standards Board and coordinates their submission to other organizations.

Description of the IEEE 1547 Series

IEEE 1547 provides the technical foundation for interconnecting DR with the grid. It provides requirements relevant to the performance, operation, testing, safety, and maintenance of the interconnection. It was approved in June 2003.

P1547.1 Draft Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources With Electric Power Systems

IEEE P1547.1 specifies tests that must be performed to demonstrate that the interconnection functions and equipment conform to IEEE 1547. Equipment that connects DR with an EPS must meet requirements specified in IEEE 1547, and standardized test procedures are necessary to verify compliance. The procedures must provide repeatable results, independent of test location, and flexibility to accommodate a variety of DR technologies.

P1547.2 Application Guide for IEEE 1547 Standard for Interconnecting Distributed Resources With Electric Power Systems

IEEE P1547.2 provides technical background and application details and characterizes DR technologies and interconnection issues. The background and rationale of the technical requirements are discussed in terms of the operation of the interconnection. The document includes technical descriptions and schematics, application guidance, and interconnection examples to enhance IEEE 1547.

P1547.3 Draft Guide for Monitoring, Information Exchange, and Control of Distributed Resources Interconnected With Electric Power Systems

IEEE P1547.3 facilitates the interoperability of one or more DR interconnected with an EPS and describes functionality parameters and methodologies for monitoring, information exchange, and control of the DR interconnected with, or associated with, an EPS.

International Electrical Standards

Links among world standards communities such as the International Electrotechnical Commission (IEC) and IEEE are essential to multinational development, deployment, testing, and certification. In 2002, IEC and IEEE agreed on a dual logo arrangement for IEC to adopt IEEE electronics, telecom, and power generation standards for international use. The scopes of some IEC efforts now closely follow efforts started in the IEEE 1547 series.

IEC created the Joint Coordination Group for Decentralized Rural Electrification Systems (JCG DRES), which the IEEE SCC21 chair convenes. IEC Technical Committee 8 (TC 8) System Aspects for Electrical Energy Supply revised its scope to address deregulation of the world's electric power industry. It will prepare the standards framework and coordinate the development of international standards needed to facilitate the functioning of electricity supply systems in open markets. The administration of the U.S. Technical Advisory Group for TC 8 is managed by the National Renewable Energy Laboratory.

In addition, IEC TC 57 Power Systems Management and Associated Information Exchange is revising its scope and will work closely with TC 8. The TC 57 scope is to prepare international standards for power systems control equipment and other systems used in the planning, operation, and maintenance of power systems. Power systems management comprises control within control centers, substations, and pieces of primary equipment.

Publications

Basso, T.; DeBlasio, R. "IEEE 1547 Series of Standards for Interconnection." NREL/CP-560-34003. May 2003.

Friedman, N., and the staff of Resource Dynamics Corp. "Distributed Energy Resources Interconnection Systems: Technology Review and Research Needs." NREL/SR-560-32459. September 2002.

IEEE SCC21 Web site:
http://grouper.ieee.org/groups/scc21/

Publications are available on the NREL database, http://www.nrel.gov/publications/.

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